

THE OHIO STATE UNIVERSITY
COMPUTER CENTER

CENTENNIAL HISTORY

September, 1969

History of The Ohio State University Computer Center

I. Founding and Early Development

The origins of the Computer Center can be traced directly to a few pieces of card handling equipment acquired in 1947 on a Research Foundation project in the Cryogenic Lab, Professor Herrick L. Johnston, Director. To provide for the computational needs of the project, a modest computing laboratory was organized with Jack Belzer as supervisor. This first computing facility featured an IBM 602A calculating punch, a 402 tabulator, a 513 reproducer, an 075 sorter and 016 keypunch which were housed in a Quonset hut located on the site of the present Chemical Engineering Building.

When the computing needs of the Cryogenic Lab project were completed, an arrangement was initiated through the Research Foundation, in the spring of 1954, for the Mathematics Department to have full use of the equipment in return for providing computational support for Research Foundation projects. Professors Leslie H. Miller, D. Ransom Whitney, Roy F. Reeves and others in the Mathematics Department were interested in seeing a University computing center established and saw in this arrangement an opportunity for getting started on a small scale. Word soon spread that the Mathematics Department was operating a facility which provided computing services to the University at large. This marked the beginning of the organization which has developed into the present Ohio State University Computer Center.

Professor Leslie H. Miller served as the first supervisor of the Math Department computing lab during the spring and summer of 1954. Professor D. Ransom Whitney supervised the facility during the fall of 1954 and was succeeded by Professor Roy F. Reeves who assumed the supervisory responsibility beginning Winter Quarter 1955. These assignments were made by Professor Robert Helsel, then Chairman of the Mathematics Department. During this early period the staff of the computer lab consisted of the faculty supervisor and one assistant, Mery L. Gong, who served as machine operator and keypuncher. Miss Gong had originally been employed as an operator by the Cryogenic Lab and stayed on when the facility was transferred to the Mathematics Department.

Early records reveal that one of the first major projects undertaken by the new computer lab on the IBM 602A calculator involved the computation of Bessel functions for the Antenna Lab in the Electrical Engineering Department. As researchers in other departments became aware of this new facility additional projects began to come in and the computational load rapidly increased. It soon became evident that a computing lab provided a useful service in the University and that the present small facility was woefully inadequate. By present electronic computer standards the IBM 602A was extremely slow and limited, running at a speed under 100 cards per minute and requiring that a special plugboard be wired for each individual application. Users were further limited by having available only 10 words of storage and a possible total of only 12 program steps. The size and complexity of some of the projects successfully completed is a credit to the perseverance and ingenuity of the users of this early calculator.

Concurrent with the operation of the 602A computing facility by the Mathematics Department, another 602A facility was providing computing services to Research Foundation projects in the Mapping and Charting Laboratory, Professor Paul M. Pepper, Director. Early in 1955 the decision was made in the Research Foundation to combine these two facilities and to replace both 602A's with an IBM Card Programmed Calculator, commonly referred to as the CPC. Dr. Roy F. Reeves agreed to continue as director of the combined facility. At this time it was also decided to move the computation lab from the Quonset hut to more adequate quarters in the Research Center. In August 1955, the computation lab moved to Area 18 of the Research Center and in September the CPC was installed, replacing the 602A. At about this same time the new computing facility was officially named the Numerical Computation Laboratory, NCL. While the CPC was not a stored program computer, it did have the ability to execute programs of arbitrary length and considerably increased the computing capabilities of the Center. The 50 positions of electronic storage coupled with the possibility of wiring up to 180 program steps made the CPC pretty impressive to the 602A user. By utilizing a general-purpose control panel wired to provide a variety of different operations, many scientific and engineering applications could be handled without preparing a special control panel. A program consisted of a deck of cards, each of which contained an instruction code which called upon a program sequence in the CPC. In addition to performing calculations, each program step could print a line of

output or punch a card. The CPC was only semi-automatic in-that a human operator was required to feed and remove cards. Iterative programs could be run by feeding the same cards through over and over again. Although the CPC, running at a maximum speed of 150 cards per minute, was extremely slow by electronic computer standards, it opened the door to larger and more complex applications and dozens of projects were successfully completed during the year of its operation at Ohio State.

While a computing center was in process of being established at Ohio State around the 602A and the CPC, large scale electronic computers had been developed which soon made these electro-mechanical devices obsolete. The concept of the general purpose, stored program electronic digital computer was originally published in 1945 in a report by Dr. John von Neumann which proposed the construction of such a computer. The first electronic digital computer, the ENIAC, was built in 1946 by Professors John Mauchly and J. P. Eckert at the University of Pennsylvania. The first stored program electronic computer operational in the United States, the SEAC, was completed in 1950 at the National Bureau of Standards while the first commercially marketed computer, the UNIVAC I, became available in 1951. In this early development period other companies soon entered the computer field and a vigorous competition for the market ensued. Numerous improvements and new developments in the technology extending the capacity, speed, and reliability resulted in an outpouring of newer model computers which rendered obsolete older models. From these modest beginnings a scant 20 years ago the computer industry evolved.

The tremendous computing ability of large scale electronic computers had obvious implications for research and members of the faculty soon recognized their potential value to the University. Early in 1952, a faculty committee was appointed to evaluate the broad requirements of the University for computing services and to make recommendations regarding the procurement of a computer and the establishment of a University computer center. This committee, which reported to Dr. Frederic W. Heimberger, labored for two years endeavoring to find a way for the University to acquire a computer. Committee members visited computer installations at other Universities and conferred extensively with the various computer manufacturers. Many alternatives were considered and at one point serious consideration was even given to the idea of building a computer at Ohio State. The primary obstacle to procuring a digital computer at this time was the great

cost. The facts were, it really mattered little whether purchasing, renting or even building was considered, obtaining and operating a large scale computer was a sufficiently costly venture to deter the University from proceeding at that time. Despite the fact that all the efforts of this committee failed in moving the University to acquire a computer, their work was important in bringing an awareness to the administration of the need for procuring a computer and establishing a modern computer center.

II. Early Computers at Ohio State

As the computation load of the Numerical Computation Laboratory continued to expand, the need of the University for a modern computing facility with a large-scale electronic computer became increasingly evident. The existing CPC facility was clearly inadequate to meet the growing needs of a large university.

Early in 1956 the administration made the decision to order an electronic computer and in June of that year an IBM 650 was installed in the Numerical Computation Laboratory. This was a momentous step and was taken with considerable anxiety and trepidation. The CPC, having served well, was returned to IBM and the Ohio State University entered the computer era. The basic 650, though considered only a medium sized computer in 1956, seemed mighty powerful to the user accustomed to the pace of a CPC. Equipped with a 2000 word magnetic drum memory with an access speed of only .091 milliseconds, the 650 was perhaps a hundred times faster than the CPC. With optimum programming it could perform upwards of 1500 additions or 400 multiplications per second. This capacity and speed enabled researchers to undertake projects on the 650 of a magnitude that would have been out of the question on the CPC.

In 1958 the basic 650 was modified to permit the use of alphabetic as well as numeric characters. It was also improved by the addition of 60 words of high speed magnetic core storage and automatic floating point instructions. These changes served to greatly simplify the programming task and increase the computing speed of the 650. At that date 60 words of fast storage was pretty impressive to the programmers and the improvements in computing speed which could be realized by effectively utilizing these few storage locations was quite surprising.

With the advent of the 650 new dimensions of growth took place within the Numerical Computation Laboratory. From only a relative handful, the number of researchers utilizing the computing facilities increased rapidly. Faculty and students from almost every field and discipline began to see the computer as a valuable tool which could assist them in their research. The need for establishing a program to train the faculty and staff of the University in the use of computers was clear. As early as the fall of 1955 non-credit seminars on the use of the CPC were taught by Dr. Reeves. During the 1956-57 academic year the seminars taught by Dr. Reeves on the use of the IBM 650 were regularly attended by more than 50 graduate students, researchers, and faculty.

In these early developing years there was an acute shortage of programmers and trained people in all branches of the computer profession. The need for developing an academic program in the University for training students in programming and the use of computers was clearly recognized. Beginning in 1956 undergraduate and beginning graduate courses in computer programming and numerical analysis were offered through the Mathematics Department. Dr. Reeves taught the first courses and was later assisted by Dr. Theodore W. Hildebrandt who joined the Mathematics Department faculty in the fall of 1957 and was appointed Assistant Director of the Numerical Computation Laboratory. Professors Reeves and Hildebrandt, assisted by members of the NCL programming staff, taught all the computer science courses in the University for the first several years. As an indication of the size of these early classes, records for the 1958-1959 academic year show that approximately 150 students were enrolled. The first classes were held in the lunch room in the basement of the Research Center. When the Numerical Computation Laboratory was remodeled in 1960 these classes were moved to the Student Laboratory (the present Research Center Branch customer work room). In the fall of 1961 these classes were moved to the fourth floor of University Hall and course instructors were required to manually transport all the student problem decks to and from the Research Center.

It was soon recognized that not only was the computer a powerful aid to research, but that it also could be a useful resource of the education program of the University. In many departments there are courses in which students are assigned lab problems requiring numerical computation for their solution. By having the students utilize the computer in the solution of these problems, instructors are able to give more assignments and cover more material. They are also able to assign larger and more realistic problems and thereby increase the effectiveness of their courses. In addition, the students can gain valuable experience in applying computers to their field of study. The program developed by the Numerical Computation Laboratory for handling this type of educational support was called the Class Work Authorization or CWA program. CWA usage in the University has grown steadily until today each year thousands of students from virtually every field of study employ the computer in connection with their academic studies.

Utilization of the 650 in support of research and education in the University increased dramatically until by 1959 it was once again evident that a more advanced computer system would be required. In February 1960 the 650 was released and an IBM 704 system was installed in its place. The 704 was a powerful large-scale computer with about 100 times the speed of the 650 and its installation placed Ohio State in the front rank of university computing facilities. It had a 4096 word magnetic core memory which was supplemented by two magnetic drums with a storage capacity of 4096 words each and by 4 magnetic tapes. Not only was the 704 much larger and faster, but its programming was more flexible which permitted its use on a wider range of problems. To accommodate the 704 the space occupied by the Numerical Computation Laboratory in the Research Center was greatly expanded and completely remodeled.

In October 1961 the computing facilities of the lab were augmented by the installation of an IBM 1620 computer in the auxiliary machine room. The 1620 is a small transistorized computer which was made available to customers on an open shop basis. It has proven to be very useful for many applications and, at the time of this writing, is still in active use. A use life of over 8 years makes the 1620 somewhat of an anomaly in the computer field.

III. Time Sharing and Remote Operation

In 1961 the Aviation Psychology Laboratory*, APL, under the direction of Professor George E. Briggs, secured a five-year Air Force sponsored project involving systems simulation research which required direct access to a large high-speed computer. It was clear the 704 could not provide the computing needs of this large project and continue to adequately serve the remainder of the campus. The University faced the choice of either acquiring a separate computer for the Aviation Psychology Laboratory or replacing the 704 with a larger computer system capable of serving the needs of both groups. The alternatives were carefully weighed and the decision made to replace the 704 by an IBM 7090. However, since the University was unable to obtain delivery of a 7090 system in time to meet the terms of the Air Force project, it was decided to first install an IBM 709 and replace it with the faster, but compatible, 7090 at a later date. The 709 was delivered in October 1961. At the same time an IBM 1401 system was also installed to handle the input-output needs of the larger system.

While the 709 was only slightly faster than the 704, it had a number of useful new features, such as 32,768 words of core storage and indirect addressing, which made it a significantly more powerful computer system. Probably its main improvement, however, was a new input-output system that permitted reading from tape or cards, writing to tape or printer, and computations to proceed simultaneously. The IBM 7090, which replaced the 709 in November 1962, was a fully transistorized computer with a 2.18 microsecond cycle time which made it approximately five times as fast as the 709.

Another significant advance that came with the installation of the 709 was the conversion to the use of a monitor or executive system to handle the job processing and control the operation of the computer. Theretofore, users either individually processed their own jobs at the computer or submitted them to be processed one at a time by a computer operator. Of course, in either case this was highly inefficient and wasteful of computer time. In order to keep apace with the fast growing computer load, it became necessary to begin operating under a monitor system. Some of the programmers who were accustomed to the old ways viewed this changeover with considerable sadness, realizing they would no longer be able to push the buttons and puzzle over their programs at the console. Such was the price of progress.

* Presently named the Human Performance Center.

This decision to replace the 704 was of far reaching significance for it committed the Numerical Computation Laboratory to provide computer support to the APL project for the next five years. It also made necessary the most ambitious systems development project ever undertaken at Ohio State.

To provide the immediate access necessary for the systems simulation research, required that the 709 (7090) be operated in a time-sharing mode which permitted the APL programs and the programs of the other computer users to be processed simultaneously. While in this time-sharing mode the APL programs occupied the upper half of the core memory and the monitor and user programs occupied the lower half. Since the IBM supplied monitor, assembler, and compiler were not designed to operate in this environment, the necessary systems had to be developed at Ohio State.

Under the direction of Dr. Reeves, a special OSU System Monitor was developed to handle this special time-sharing operation with the Aviation Psychology Laboratory. This operating system contained a universal input-output control system, a FAP assembly routine modified to operate in 16K of core, and an algebraic compiler, named SCATRAN, which also was capable of operation while the 709 was in the time-sharing mode. Dr. Reeves, who conceived and designed the entire system and directly supervised its implementation, must be given the major credit for the success of the whole undertaking. The OSU System Monitor was a highly unique and sophisticated system for its day and certainly ranks as one of the most significant accomplishments of the Computer Center. For such a small staff it was a very ambitious undertaking and perhaps most impressive of all was the fact that the completion deadlines were met. An unusual accomplishment for most major software developments.

The SCATRAN compiler, which became operational in June 1962, was much faster than its contemporary FORTRAN II. In addition, the SCATRAN language provided far more flexibility and conciseness of expression. SCATRAN was well received by nearly all programmers and is still in active use today on the 7094 system.

The time-sharing arrangement with the Aviation Psychology Laboratory had both its good and bad aspects. Since the 709 (7090) system was generally operating in the time-sharing mode during the 8 to 5 period each day, users with jobs requiring more than half of core were required to wait until evening for their programs to be processed. Also, the special OSU operating system precluded the

use of most new programs and systems provided by IBM or obtained from other outside sources. On the other hand, the programming staff obtained much valuable experience from the development of the system and from the time-sharing operation which proved helpful in later system developments.

The location of the Numerical Computation Laboratory in the Research Center was inconvenient for the vast majority of computer users on campus. It was not uncommon for researchers and students to make 3 and 4 trips per day to submit and retrieve programs or secure consultive assistance. It was especially frustrating to make a special trip to the Research Center only to find that your job had not been processed and either a long wait or another trip made necessary.

An even more critical condition was developing, however, which made necessary important changes in the mode of operation of the Numerical Computation Laboratory. The number of computer users in the University had grown to the point where the facilities of the Research Center were no longer adequate. During the heavy processing period of each quarter the laboratory became so congested that students and researchers alike found it increasingly difficult to obtain access to the equipment and secure the services needed. It became clear that it was no longer possible, or even desirable, to have all users work through a single center.

To alleviate this situation a satellite station, known as the Data Center*, was established in April 1962 in Robinson Laboratory in the College of Engineering. This center contained an auxiliary machine room equipped with keypunches and other equipment necessary for preparing program and data decks, a customer work room, facilities for program submittal, and a programmer consultation station. This allowed students and researchers on the main campus to prepare and submit their programs without making a trip to the Research Center. These programs were collected in batches, transported by bus to the Research Center for processing on the 709 (7090), and then transported back to the Data Center for distribution to their submitters. G. Miller Clarke, a programmer was the first supervisor of the Robinson Laboratory Data Center.

* Now called the Robinson Laboratory Branch.

In November 1962, after one year of operation, the 709 system was replaced by an IBM 7090 system which, in turn, after less than a year of operation was replaced in September 1963 by an IBM 7094 system. The 7094 was fully compatible with the 7090 and, with a 2 microsecond memory cycle, was slightly faster. More important, however, it had 4 additional index registers, built in double precision operations, and several other useful instructions. The decision to convert to a 7094 so soon was made to enable the University to acquire the more advanced system while they could still take advantage of the IBM educational discount plan which was being dropped. The 7094 system is still in heavy use by many researchers after more than 6 years of operation.

With the installation of the 7094 the decision was made to undertake the transmission of jobs from the Robinson Laboratory Data Center to the Research Center via telephone lines. To accomplish this the 1401 in the Research Center was replaced by an IBM 1410 which was linked by telephone lines to a 1401 installed in the Data Center. The 1410-1401 operating system for handling this remote processing operation was designed and developed by Dr. Reeves and others on the programming staff. The 1410 system was designed so that the card to tape, or tape to print/punch functions could be in simultaneous operation with the remote telephone line transmission while the 7094 system was processing other jobs.

This remote batch processing operation through the Data Center proved highly successful and within a few quarters the new center also became overcrowded. The decision was made to establish additional data centers at convenient locations on the campus as soon as space became available. In March 1966 a small data center was established in Plumb Hall to serve the College of Agriculture on the west campus, and in February 1967 a third center was opened in the basement of Hagerty Hall to serve the needs of that end of the campus. These branch centers are now officially named the Robinson Lab Branch, Plumb Hall Branch, and the Hagerty Hall Branch. The Plumb Hall Branch was equipped with an IBM 1974 system and the Hagerty Hall Branch with a 1401, each linked with the 1410 by telephone lines to permit remote job processing.

The objective behind the establishment of Branch Centers has been to make the facilities of the Computer Center as accessible as possible to the entire university community. With this in mind, the Branch Centers were equipped and staffed to provide all the computer

services that were available through the main center. In addition to the terminal facilities, they include auxiliary machine rooms, customer work rooms, program submittal stations, and programmer consultation areas. The Branch Centers have proven very successful in making the computer more accessible to students and faculty, in distributing the load, and improving the overall customer services. Plans are in progress for the establishment of additional branch centers.

Mention should also be made of one other important development in the University which received much of its initial impetus during this period from the efforts and interests of certain Computer Center staff members. Beginning in the early 1960's growing interest developed for establishing in the University graduate academic programs in the computer and information sciences. It was the belief that this important new science and field of study had developed to the point that a separate academic department should be established. As interest grew and the idea crystallized, proposals were submitted to the administration and Dr. Reeves and Dr. Hildebrandt were very much involved in the endeavor to make the administration recognize this need. Dr. Reeves served on a faculty committee which recommended the establishment of a Division of Information Science and also served as chairman of another committee promoting the creation of a Computer Science Division. After months of effort, their hard labors were rewarded by the establishment in 1966 of a Division of Computer Science and a Division of Information Science. In June 1966 Dr. Hildebrandt, who served as Assistant Director for nine years, resigned from his position in the Computer Center to become acting chairman of the new Computer Science Division. At this same time Dr. James B. Randels and Dr. Clinton R. Foulk, Math Analysts, also resigned their positions in the Computer Center to accept faculty appointments in the new divisions. In June 1967 the two new divisions merged to form the Department of Computer and Information Science with Dr. Marshall C. Yovits as chairman and Dr. Theodore W. Hildebrandt as associate chairman.

Effective July 1, 1964 the name of the Numerical Computation Laboratory was officially changed to the Computer Center.

IV. The Computer Center Today

The nineteen sixties brought new advances in computer technology and new concepts of computer systems design which in turn brought forth a new era of third-generation computer systems. These new systems became available in the late 1960's and brought many new features such as multiprogramming, time-sharing, mass storage devices, exciting new input-output capabilities and new media for accessing computers and displaying results, as well as tremendous advances in speed and versatility. To better serve the needs of the rapidly growing and sophisticated user community and to maintain at the University a top echelon computer facility, the Computer Center proposed early in 1964 that the University order one of these newly announced third-generation computer systems.

Selecting a new computer system is at best a difficult and challenging task and once again an intensive study was undertaken of all announced computer systems which to some degree appeared to meet the needs of the University. This process involved months of seminars, presentations, conferences as well as study, analysis and comparison of system specifications. Even then the choice was extremely difficult to make. Finally in June 1964 the decision was made to order a General Electric 635 which was to be installed in September 1966 and then to be replaced in December 1968 by the larger and more advanced GE 645 system. In July 1964 a proposal was submitted to the National Science Foundation seeking their financial aid in installing and operating this new enlarged computer system. To prepare for the installation of this completely new computer system the programming staff launched into the mammoth program conversion which was necessarily involved. This task included the conversion of the SCATRAN compiler to operate on the 635, all of the library programs, and many customer programs to which the Computer Center had a commitment.

While the programming staff was working feverishly to complete the program conversion in order to be ready for the scheduled September installation, the Computer Center administrators followed with apprehension reports of serious problems developing with the GE 635 and 645 systems. The bench mark tests on the 635 were very disappointing and serious problems were showing up in both the hardware and software of the 645 system. Because of the continued failure to meet performance specifications, the decision was made in January 1966 not to accept delivery of the 635 in

September but rather to wait and watch developments on the G. E. systems and to restudy the status of other systems available.

This delay in the installation of a new computer system made it necessary for the University to rely on the 7094 for at least another additional year. A careful study of the economics of the situation convinced the University it would be to their financial advantage to purchase the 7094 rather than continue renting. Therefore, in the spring of 1966 Ohio State became the owner of a slightly used 7094. In the spring of 1967 the 1410 was replaced by an IBM 1460 and a 7711 transmission unit. Also, in February 1967 the Hagerty Hall Branch was opened which helped greatly to alleviate the overloaded Robinson Laboratory Branch and to balance the fast growing student load.

Troubles with the General Electric systems continued to compound and in September 1966 the company announced that its 645 system had been withdrawn from the market. Since the 635 had originally been intended as only an interim system until a 645 could be installed, this left Ohio State with no alternative except to cancel its order for a 635 and look elsewhere for a replacement system.

A restudy of the available systems convinced those charged with the responsibility of selecting a new computer system that the IBM System/360 Model 67 time-sharing system most nearly met Ohio State's needs. The initial plan was to install a Model 50 in August 1967 to be followed in April 1968 by a Model 67. The Model 50 and the 7094 would remain until the Model 67 was operational and had demonstrated its ability to carry the load. The recommendation of these systems was submitted to the administration in late November 1966. Again the fates were not smiling for by January the University began receiving reports that the Model 67 time-sharing system was not performing well. Again it was felt the wisest course was to wait and watch developments with the IBM systems and other manufacturer's systems. Continuing reports of disappointing performances by the 67 system convinced the University that this was not the way to go.

Finally in June 1967 the University made the decision to order IBM Model 50 and Model 75 computer systems. They were to be run separately with the Model 75 to handle the batch processing needs and the Model 50 devoted to supporting time-sharing systems.

In 1967 construction had begun on the new Systems Engineering Building which was being built to house the Computer Center and the Department of Industrial Engineering. The Model 50 was scheduled to be installed as soon as the new facility was ready for occupancy and the Model 75 in July 1968.

Because of the delays in installing its own time-sharing computer system, the Computer Center made available to its users beginning in September 1967 the General Electric and Com-Share commercial time-sharing systems. Public teletype terminals were installed in the Research Center, Robinson Laboratory, and Hagerty Hall Branch Centers. These systems were brought in to give interested users an opportunity to use and experiment with time-sharing on a limited scale in preparation for the later installation of the University's own system. These services remained available through June 1969 and were used by over one hundred different researchers. These commercial services, though quite costly, did serve the purpose of preparing many for the later installed University time-sharing systems.

Although delays occurred in the completion of the new Systems Engineering Building, the Computer Center finally occupied its new facilities and began installation of the IBM 360 systems in September 1968. The staff of the Computer Center had prepared well and the new systems were installed and made operational with few delays or unforeseen problems. The program conversion problems were handled smoothly and the systems programmers, under the direction of Systems Programming Supervisor Edwin R. Lassette, did an outstanding job in preparing for the installation and operation of the new systems. Because of their careful planning and preparation Ohio State avoided many of the problems and delays which beset many other installations who had planned and prepared less carefully. The Model 75 system was carefully tested and released for customer use on November 1, 1968. The CPS time-sharing system was made operational on the Model 50 and released for public use on January 1, 1969.

At the present time the Ohio State University Computer Center is one of the best equipped computer installations in the country. The central facility, located on the fourth and fifth floors of the Systems Engineering Building, includes IBM System/360 Model 75, Model 50, and 1130 computer systems as well as the administrative

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In the auxiliary machine room of the Systems Engineering Center is an IBM 1130 system which is available to all research users on an open shop basis. This small computer system includes 16 thousand words of core storage, a half-million words of disk storage, printer, card read/punch, paper tape read/punch, a drum plotter, and a console display unit. This is a very heavily used system, primarily in connection with plotting and other graphics applications.

The Research Center Branch includes, in addition to the 1130 terminal, the IBM 7094 system which is still heavily used by numerous researchers, an IBM 1620 system which includes a drum plotter, and an analog-to-digital conversion system.

The Computer Center also has a Digital Equipment Corporation PDP-9 computer system which is located in Electronics Laboratory. This system is maintained for research use and is administered through the Electrical Engineering Department with Professor C. Earl Warren serving as supervisor.

The past fifteen years have brought many changes and much growth in the Computer Center. From a small, unofficial departmental computing laboratory with a staff consisting of a professor and a part-time student, it has developed into one of the finest computer installations in the nation with a staff of over one hundred. During this period the growth in utilization by faculty and students has been almost exponential. From just a few projects the first year, drawn primarily from engineering and physical sciences, the Center now is supporting in excess of a thousand active research projects. Scientists and scholars from virtually every field of study are finding the computer a valuable tool enabling them to undertake investigations not thought feasible a few years ago. Even in the humanities and the fine arts scholars in increasing numbers are finding ways the computer can assist them in their studies. Today the students who employ the computer in connection with their coursework each year are numbered in the thousands and increasing numbers of faculty from many departments are making it an integral part of their courses.

V. APPENDIX: The Computer Center Staff

In this brief history it is not possible to list all the staff members who have contributed to the growth and development of the Computer Center. Many were part-time student employees who worked in the Center for a year or two then graduated and left the University. Certainly some of these students became excellent programmers and operators and made important contributions to the Computer Center. This account would, however, be grossly incomplete without mentioning, if only briefly, those members of the staff who through the years have served in administrative and supervisory capacities or who through their talents and labor have made significant contributions to the advancement and growth of the Center.

A. DIRECTORS

Dr. Leslie H. Miller served as the first director during the Spring and Summer Quarters of 1954 when the Center was established in the Mathematics Department. Dr. Miller is presently a Professor of Mathematics.

Dr. D. Ransom Whitney served as director of the Center during Autumn Quarter of 1964 and had previously been a member of the faculty committee that recommended the establishment of a University Computer Center. At the present time Dr. Whitney is the director of the Statistics Laboratory and a Professor of Mathematics.

Dr. Roy F. Reeves has served as director since December 1954 and certainly must receive the major credit for providing the leadership and direction through the years that have brought the Computer Center to its present position. His wide knowledge, experience, and sound judgement have always been sought by the University administration and have played a prominent role in every major decision effecting the course of the Center. Dr. Reeves is not only a successful administrator of a large computer installation but also a computer scientist of national reputation and a recognized authority in the field. In addition to serving as the Director of the

Dr. Roy F. Reeves (continued)

Computer Center, Dr. Reeves is a Professor of Mathematics and a Professor of Computer and Information Science. He also holds the position of Associate to the Vice-President for Research and serves as chairman of the Computer Center Faculty Advisory Committee.

B. ASSISTANT DIRECTORS

Dr. Theodore W. Hildebrandt served as Assistant Director of the Computer Center from 1957 to 1966 and as an Associate Professor of Mathematics. In July 1966 Dr. Hildebrandt resigned these positions to become Acting Chairman of the new Computer Science Division. In July 1967 he was appointed as Associate Chairman and Professor in the new Computer and Information Science Department. Dr. Hildebrandt left the University in 1968 and at the present time is Computer Center Director at the National Center for Atmospheric Research in Boulder, Colorado.

C. COMPUTER CENTER EXECUTIVE COMMITTEE

Mery L. Gong, Assistant to the Director for Administration.

Miss Gong was employed as a keypuncher and machine operator when the computing facility was first established in the Mathematics Department in 1954. When the IBM 650 was installed she served as a computer operator and programmer. In 1960 she was appointed as Operations Supervisor of the Computer Center and served in that capacity until 1965. From 1965 to the present date she has served as Administrative Assistant to the Director

Dickson H. Call, Assistant to the Director in Charge of Programming.

Mr. Call joined the Computer Center staff in 1957 as a Research Associate and served as an applications programmer. From 1963 to 1965 he served as Applications Programming Supervisor and was appointed to his present position as Programming Supervisor in 1965.

Martha K. Finch, Assistant to the Director in Charge of Operations.

Mrs. Finch joined the staff in 1962 as a computer operator. In 1965 she was appointed to her present position of Operations Supervisor.

Dr. William M. Wagner, Assistant to the Director for Mathematical and Systems Analysis.

Dr. Wagner first joined the staff in 1961 as a Systems Programmer and in 1962 was appointed Chief Systems Programmer. He left the Center in 1963 to continue his graduate studies at the Iowa State University. After working in industry, he returned to the Center in 1967 as an Analyst. In 1968 he was appointed Supervisor of Mathematical and Systems Analysis and serves in that capacity at the present date.

Dr. James B. Randels, Supervisor of Program Libraries.

Dr. Randels first joined the staff in 1957 as a Graduate Assistant. Leaving in 1958 to work in industry, he returned to the Center in 1961 as a Research Associate. In 1963 he was appointed Chief Systems Programmer and again as a Research Associate in 1964. In 1965 he was appointed Math Analyst and an Assistant Professor in the Department of Mathematics. In 1966 he again left the Center to join the faculty of the new Computer Science Division as an Assistant Professor. He returned to the Center in 1967 and at the present time is the Supervisor of Program Libraries and an Assistant Professor of Computer and Information Sciences.

Oscar L. Fleckner, Jr., Systems Programming Supervisor.

Mr. Fleckner joined the staff in 1963 as a Research Assistant and served as an applications programmer. In 1965 he was assigned as a systems programmer and in July 1969 appointed to his present position as Systems Programming Supervisor.

Earl M. Raley, Applications Programming Supervisor.

Mr. Raley joined the staff in 1964 as an applications programmer. In 1965 he was appointed to his present position of Applications Programming Supervisor.

Robert A. Grahl, Supervisor of Information Services.

Mr. Grahl joined the staff of the Computer Center in 1968 as an applications programmer and was appointed to his present position as Supervisor of Information Services in 1969.

D. PRESENT FULL-TIME STAFF (Starting Date, positions held)

Dennis M. Amicon, 1968, Computer Operator.

Gladys E. Atkinson, 1969, Machine Operator.

John R. Beach, 1967, Applications Programmer, Hagerty Hall Branch Programming Supervisor.

Stephan W. Beam, 1966, Computer Operator.

Charlotte M. Belchar, 1967, Machine Operator.

Robert R. Bell, 1969, Computer Operator.

Lonnie A. Berkebile, 1968, Applications Programmer.

Dr. Paul F. Buerger, 1968, Systems Programmer.

John H. Caldwell, 1967, Computer Operator, Plumb Hall Branch Operations Supervisor.

Samuel J. Cardman, 1967, Applications Programmer.

James E. Cates, 1968, Applications Programmer.

O'Neil B. Chambers, 1968, Computer Operator.

Robert C. Chase, 1965, Programmer, Math Analyst.

Roger A. Coy, 1967, Computer Operator.

Ruth K. Decker, 1962, Programmer, former Supervisor of Information Services.

Edmond C. DiSabato, 1967, Computer Operator.

Carl R. Dobbins, 1963, Computer Operator, Systems Engineering Machine Room Supervisor.

Ned A. Edwards, 1967, Computer Operator.

Carol F. Estep, 1968, Applications Programmer, Research Center Branch Programming Supervisor.

Pravin Gandhi, 1966, Applications Programmer, Programming Section Leader.

Barry D. Gilligan, 1966, Programmer, Assistant Operations Supervisor.

Rosa L. Gilman, 1967, Machine Operator.

Madhukar B. Golhar, 1968, Applications Programmer, Statistician.

Cecil C. Grant, 1964, Computer Operator, Robinson Laboratory Branch Operations Supervisor.

Cheryl L. Harter, 1969, Machine Operator.

James E. Hawks, 1968, Computer Operator.

John L. Henderson, 1969, Applications Programmer.

Sara J. Hobson, 1968, Machine Operator.

Raymond Jang, 1967, Applications Programmer.

Ronald B. Jenkins, 1969, Computer Operator.

David K. Johnston, 1967, Applications Programmer.

Kenneth E. Jones, 1968, Computer Operator.

Charles G. Keane, 1968, Applications Programmer.

Charles L. Kenneby, 1968, Applications Programmer.

Dr. Frederick S. Koehl, 1966, Systems Programmer, Math Analyst.

Harold B. Lambert, 1968, Computer Operator.

Dixie L. Leeper, 1966, Computer Operator.

Yau-Tang Lin, 1968, Applications Programmer.

Gayle D. Littleton, 1969, Machine Operator.

Harold E. Lybarger, 1965, Computer Operator, Research
Center Branch Operations Supervisor.

Thomas L. Martin, 1969, Computer Operator.

Jack D. Mauersberg, 1968, Applications Programmer.

Carole A. Maurer, 1967, Applications Programmer.

Owen R. Miller, 1967, Systems Programmer.

Marian G. Moore, 1968, Applications Programmer, Systems
Programmer.

Kathy M. Moreno, 1969, Machine Operator.

Karin L. Morris, 1968, Applications Programmer.

Robert L. Neff, 1969, Computer Operator.

J. Carroll Notestine, 1965, Applications Programmer,
Programming Section Leader.

Joan J. Peaks, 1967, Machine Operator.

Nancy A. Penn, 1966, Machine Operator.

Doris E. Perry, 1967, Machine Operator.

Michael J. Peters, 1969, Computer Operator.

James L. Phelps, 1968, Computer Operator.

Patricia O. Ratz, 1967, Applications Programmer, Systems
Programmer.

James A. Reed, 1969, Computer Operator.

Gregory A. Roddy, 1967, Computer Operator.

Kenneth P. Rockey, 1969, Computer Operator.

Ronnie B. Rosen, 1968, Applications Programmer.

Susan Salvadore, 1967, Computer Operator.

Charles H. Sechler, 1966, Applications Programmer.

James P. Shaffer, 1962, Systems Programmer, Computer
Graphics Supervisor.

Raymond D. Sheets, 1964, Computer Operator, Machine Room Supervisor.

Gerald A. Shifrin, 1968, Applications Programmer, Systems Programmer.

Lonnie S. Smith, 1969, Applications Programmer.

Robert H. Sommer, 1969, Applications Programmer.

Eileen K. Swanson, 1967, Applications Programmer.

David Tavaglione, 1963, Applications Programmer, Robinson Laboratory Branch Programming Supervisor.

James L. Throckmorton, 1964, Applications Programmer, Systems Programmer.

Michael A. Tippie, 1967, Computer Operator.

Linda R. Trigg, 1966, Computer Operator.

Daniel E. Underwood, 1968, Applications Programmer.

Ronald J. Vershinski, 1965, Computer Operator, Machine Room Supervisor.

James D. Wagner, 1964, Applications Programmer, Programming Section Leader.

Marilyn T. Welles, 1966, Programmer.

V'Non Eugene West, 1967, Computer Operator.

Thomas G. Whitney, 1969, Applications Programmer.

Kenneth C. Wilson, 1969, Computer Operator.

Malcolm D. Woodard, 1965, Applications Programmer.

Conchita C. Yao, 1968, Programmer.

E. COMPUTER CENTER OFFICE STAFF

Nancy E. Mittendorf, 1962, Computer Center Secretary.

Ethel M. Stocker, 1966, Bookkeeper.

Catherine M. Norris, 1957, Secretary (formerly Computer Center Secretary).

Sally A. Sieling, 1968, Secretary.

Lila M. Hunter, 1969, Librarian.

Beverly A. Rutherford, 1968, Secretary.

F. FORMER COMPUTER CENTER STAFF

Sally J. Bonsack, 1961-1966, Systems Programmer.

Gladys M. Brachvogel, 1966-1969, Auxiliary Machine Room Supervisor.

Dr. James H. Brann, 1962-1966, Applications Programmer, Math Analyst.

G. Miller Clarke, 1958-1965, Programmer, Supervisor of Robinson Laboratory Data Center, Systems Programming Supervisor.

Alden Dalzell, 1955-1957, Research Associate, Programmer.

Douglas J. Fleckner, 1965-1967, Systems Programmer.

Dr. Clinton R. Foulk, 1963-1966, Math Analyst.

Rusty Haley, 1955-1957, Computer Center Secretary.

Marvin E. Hardenbrook, 1956-1963, Research Assistant, Programmer.

William R. Irion, 1961-1962, Systems Programmer.

Edwin R. Lassettre, 1963-1969, Systems Programmer, Systems Programming Supervisor.

Dr. Shen Lin, 1962-1964, Applications Programmer.

Donald P. Miller, 1960-1963, Computer Operator, Programmer.

Robert Mosier, 1956-1957, Programmer.

Ian Oliver, 1967-1968, Applications Programmer, Statistical Consultant.

Joan M. Rosato, 1960-1964, Computer Center Secretary.

Jade Lin Simonson, 1961-1967, Applications Programmer, Program Librarian.

Marion L. Tripp, 1964-1967, Applications Programmer, Systems Programmer.

Judith A. Smith, 1964-1967, Applications Programmer, Systems Programmer.

Bailey Wade, 1955-1956, Programmer.

Joyce E. Wilson, 1964-1967, Applications Programmer.

Cynthia C. Yang, 1958-1966, Applications Programmer, Systems Programmer.